

# Consultant's Corner: Vibration Isolation



consultants corner

## Vibration isolation protects gen set surroundings

No isolation is required to protect a generator set from self-induced vibrations. Caterpillar gen sets are designed to absorb all normal vibrations created internally as well as most external shock loads.

This is not true of the gen set environment. Idle gen sets, auxiliary equipment such as relays and switches, and building structures can be adversely affected by vibration from an operating gen set.

## Vibration types

There are two types of generator set vibration: torsional and linear. Torsional vibration results from combustion forces imposed on the engine crankshaft that is transmitted to the total rotating mass. Except in unusual installations, proper matching of engine and generator set at the factory completely avoids this type of vibration.

Linear vibration has many causes and can usually be linked to shaking and noisy machinery. Its exact nature is often difficult to define without instruments, because total vibration measured is approximately a sum of vibration sources. (See chart 1).

## Vibration effects

There will always be some vibration in rotating machinery like an operating gen set, so it is good practice to specify isolation of the unit. The unit should not rest directly on rock, soil, steel or concrete. These materials can transmit vibrations long distances.

Resonance of certain gen set frequencies with the natural frequencies of building structural members can cause damage to some types of construction.

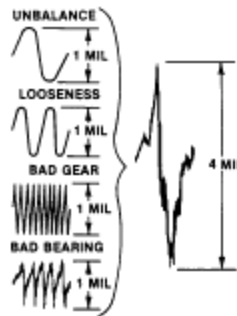


Figure 1: Vibration measured is approximately a sum of all vibration sources. Testing can determine sources

Separating the gen set from the surroundings can be done with a bulk isolator such as an inertia block or with commercial isolators.

The bulk isolators is the more expensive and elaborate of the two systems. It consists of a massive block on which the gen set is mounted. The block is surrounded by cork or fiberglass, separating it from the surrounding structure.

Rubber pads are sometimes used to dampen high frequencies which cause noise, but the most often-used device is the spring-type isolator. It offers about 95 percent isolation of all vibration and eliminates the need for an inertia block.

Spring isolators are placed under the gen set rails but are not bolted to the floor unless the unit is paralleled with other generator sets or is in an earthquake-prone area. Spring isolators are most effective when located directly under the engine and generator mounting feet.

Care must be taken to make sure the spring can accommodate the gen set's weight. If the spring is compressed completely, all vibration will be directly transmitted to the structure it rests on.



**Consider idle units**

Units that are not operating can be damaged by vibrations set up by nearby operating units. Because the idled units have no oil pressure to keep internal components lubricated, the vibration can cause severe damage. Here, spring isolators can minimize vibration effects.

Fuel lines, exhaust piping and electrical connections all transmit vibrations. It is a waste of effort to provide mounting protection unless these connections are specified to have vibration- limiting connections. Each connection must be isolated with flexible connections to provide maximum vibration reduction.

Resonance of pipe systems can also be reduced by hanging supports at unequal distances. (See figure 2). To attenuate low-frequency vibrations, specify spring-type isolator pipe hangers. High-frequency vibrations can be minimized with rubber or cork cushioned hangers.



Figure 2: Specify hangers to be installed at uneven intervals to minimize pipe vibration problems

It is possible to test complete systems to ensure vibrations are not excessive. If a structure is sensitive to vibration from gen set operation, such test should be considered before the unit is commissioned. Toromont Engine Power Systems can advise you how such tests can be carried out.

*Vibration problems can cause considerable damage, and it is best solved when the specifications is written. The addition of spring isolators or an inertia block as well as flexible connections on piping and electric lines can prevent many difficulties later on.*